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MODERN MOTION PICTURE FILM LABORATORY PRACTICE

By

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Modern Motion Picture Film Laboratory Practice

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SYNOPSIS

This paper deals with the following points :—

1. *The importance of sensitometers and densitometers.*
2. *The use of variable lamp current for sound track recording, together with a standard developing time to secure correct sound track density.*
3. *The use of test strips when processing positive prints and the comparison between American and English gamma values.*
4. *Various developing formulæ and the difference in development speed for picture and sound negatives.*
5. *Two main types of release printers.*
6. *Automatic light control printers employing air pressure.*
7. *The " Cinex " sensitometer.*
8. *Developing machines.*
9. *The elimination of directional effects and the electric regeneration of fixing baths*
10. *Negative and print examination.*

THE purpose of this paper is to discuss some of the methods and equipment used in the laboratories of England and the U.S.A. for the processing of motion picture film. It must be remembered, however, that laboratories vary considerably in regard to capacity, some having an output of 100,000 feet or so weekly, while others have output requirements running into millions of feet per week. It follows, therefore, that methods and equipment considered essential to a large laboratory may not necessarily be required by the smaller laboratory.

Sensitometers and Densitometers

In many of the smaller laboratories the development of positive prints is still controlled by the personal judgment of the man in charge of the department. By varying the time of development within certain limits, the machine operator attempts to compensate for developer exhaustion and also for small errors in printer grading Most of the larger laboratories, however, control the negative developer and the positive film development by sensitometric means, and since photographic sensitometry occupies such an important part in the modern laboratory, it will be worth while, perhaps, to discuss very briefly the sensitometric apparatus required and its application to the development of picture negative, sound negative, and positive prints.

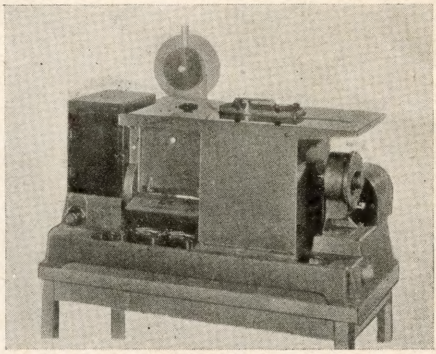

FIG. 1

The equipment required consists of a machine capable of impressing on the film to be used an accurately pre-determined scale of exposures which can be maintained constant from test to test over a very long period of time, and an apparatus for measuring the densities resulting from development of the film bearing the series of exposures. These instruments are known as the Sensitometer and the Densitometer respectively. The sensitometer most used in the motion picture laboratories of England and the U.S.A. is the Eastman Type 2B. Sensitometer, shown in Fig. 1. This is a time scale instrument, that is, the exposures are increased from step to step by an increase in time of exposure with a constant intensity light source. The exposure scale consists of twenty-one steps, each step receiving an exposure 1.414 times as long as the next shorter. There are two lamps used, one for positive film and one for negative. In the case of the former the lamp is standardised for candle-power at 2,360 deg. K. and it is used in conjunction with a filter in order to raise the radiation at the exposure plane to approximately 5,400 deg. K, which matches fairly well the colours of mean noon sunlight. The lamp for positive film is used with a filter to raise the colour temperature at the exposure plane to 3,000 deg. K. This instrument was specially designed for the motion picture laboratory, is of rugged construction and is simple to operate.

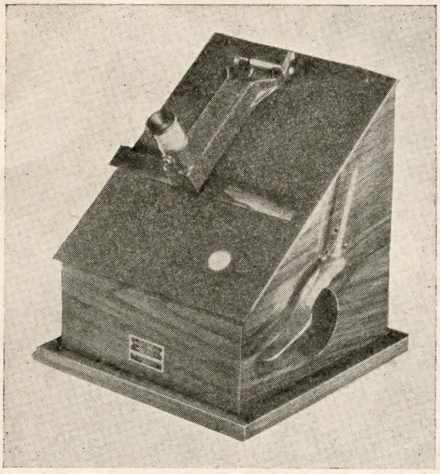

Fig. 2

Densitometers

There are a variety of densitometers in use in motion picture laboratories, mostly reading in diffuse densities, ranging from comparatively inexpensive instruments, such as the Kodak densitometer, to photocell densitometers complete with automatic curve plotting apparatus. The Kodak densitometer, shown in Fig. 2, is very simple to operate, reads directly in density values over a range from zero to 3.0, and having a field of 0.5 square millimeter is particularly suitable for sound track density measurement.

General practice in the case of new developers at all large laboratories is to make a series of sensitometric exposures on the appropriate film, and to develop these strips for a series of times within the working limits of the particular developing machine used. In this connection it is necessary for all sensitometric strips to be put through the continuous developing machine with the light exposure end leading the heavy exposure end in order to obviate variations due to "directional effects." It is customary, therefore, to punch-mark the light exposure end of each sensitometric strip, so as to give the required information to the developing machine operator.

The densities resulting from the processed sensitometric strips are then measured on the densitometer, and since the time of exposure for each density step of the sensitometric strip is known, it is possible to construct a series of density-log exposure curves From the information contained in these curves a time of development-gamma value curve is then drawn, from which in turn the correct time of development necessary to produce the required gamma value on the particular film stock used is readily obtained. A typical time-gamma curve for positive film is shown in Fig. 3.

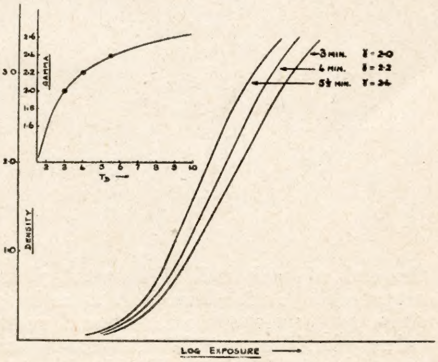

Fig. 3

Although it is undesirable that a discussion on some of the methods and equipment used in a modern film laboratory should give more than a shadowy outline of photographic sensitometry, it will perhaps be advisable to point out that gamma, which is the tangent of the angle formed by the straight-line portion of the characteristic curve and the log exposure axis, is an indication of the degree of development only, and must not be confused with contrast, which depends upon factors connected with balance of exposures in the camera as well as the degree of development.

Picture Negative Development

There are two methods in use by laboratories for the development of picture negative film. Most generally used is the test method, in which test strips are taken from the end of each roll of exposed picture negative sent in for development, and these strips are developed to the normal gamma value, which in most laboratories appears to be from 0.65 to 0.70. The developed test strips are then examined by the man in charge of the department, who determines by personal judgment the development time required by the particular roll from which a test piece was taken. The action of the developer itself is maintained constant by varying either the replenisher rate or the machine speed, according to the results obtained by developing at frequent intervals negative film sensitometric strips.

The other method, used in both England and the U.S.A. by large laboratories usually attached to a particular studio, is to develop all studio takes to a constant gamma value of 0.65—0.70, no test strips being taken from the exposed picture negative rolls. Actually, of course, the two methods do not vary greatly in results, because modifications in development time to compensate for over- or under-exposure can only be carried out successfully between relatively narrow limits. When, for instance, a negative take which has been badly under-exposed originally and over-developed to "save it" is cut in with normal exposures on either side of it, the print, which is developed to a standard gamma value, when projected will inevitably show a loss in quality on that particular scene.

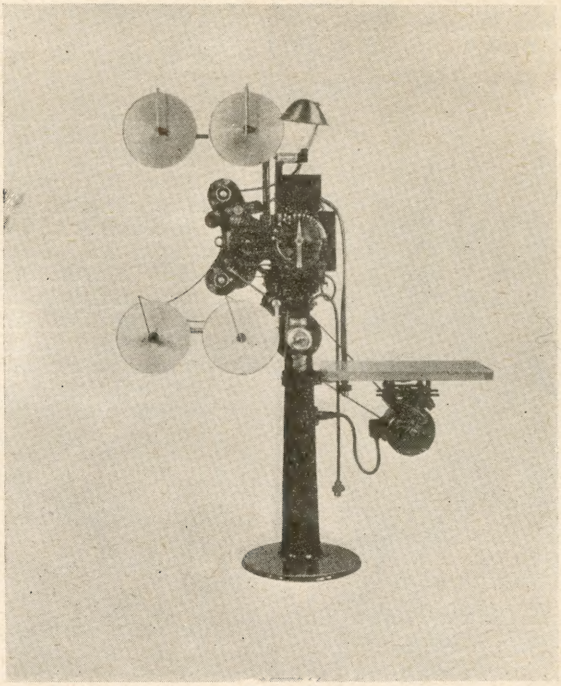

FIG. 4

Sound Track Negative Development

Turning now to the development of negative sound track, it will be unnecessary to give more than a rough outline of the methods used, since it is customary for the laboratory to adhere to the specifications given to them by either the manufacturers of the particular sound system or by the studios using the equipment. There are two main types of sound recording, variable width and variable density. In the case of the former system the laboratory usually receives instructions to develop the track to a certain density, in most variable width systems between 1.2 and 1.5, in the positive developer. The correct exposure on the film in the recorder to achieve the required density at a normal developing time in the particular positive developer is obtained by exposing sound recording film to a series of lamp current changes in the recorder, developing the exposed film in the positive developer for the normal time and selecting the lamp current giving the required density. Most laboratories use the normal positive print developing machines for processing variable width sound track, but a few use a separate lay-out for this work.

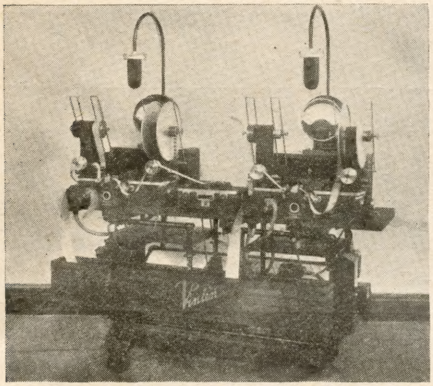

Fig. 5

The Western Electric variable density recording system is much more complex in its requirements in so far as the laboratory is concerned, and it is the practice of the Western Electric Company to make their recommendations only after an exhaustive sensitometric survey of the conditions obtaining at the particular laboratory. Briefly, however, variable density track is developed in a borax type developer to a low gamma value, varying from about 0.35 to 0.45, depending upon the laboratory, and having unbiassed, unmodulated negative densities of from 0.55 to 0.65. It is necessary to maintain the sound negative gamma at a low figure, because the system requires that the overall gamma, that is, the product of the negative and positive control gammas multiplied by the projection factor, shall be unity, and the picture requirements on the print require that the positive shall be developed to gamma values of 2.00 and over.

Positive Development

The development of positive film containing prints of both sound and picture is controlled in the larger laboratories entirely by sensitometric means, the practice being to maintain a pre-determined gamma value by altering the machine speed (or the replenisher flow) according to the indications obtained from sensitometric exposures on strips of positive film which are run through the machine at hourly or half-hourly intervals. The gamma values to which prints are developed vary from laboratory to laboratory. In general, however, it can be said that in England the lowest gamma value adhered to by any laboratory is about 2.10 and the highest 2.45, whereas in the United States these values run from about 1.9 to 2.4, although the majority of American laboratories operate between 2.0 and 2.2.

The development of master positives on lavender duplicating positive film is carried out under the same conditions as those described for positive film. The exposure requirements for this class of film vary considerably, according to the opinions held in the particular laboratory upon the vexed subject of duplicating, but it is safe to say that the correct master positive after development is always denser than a normal release print on the same subject. In general, perhaps, the practice is to print the master positives about two printer points higher than would be used for the release print.

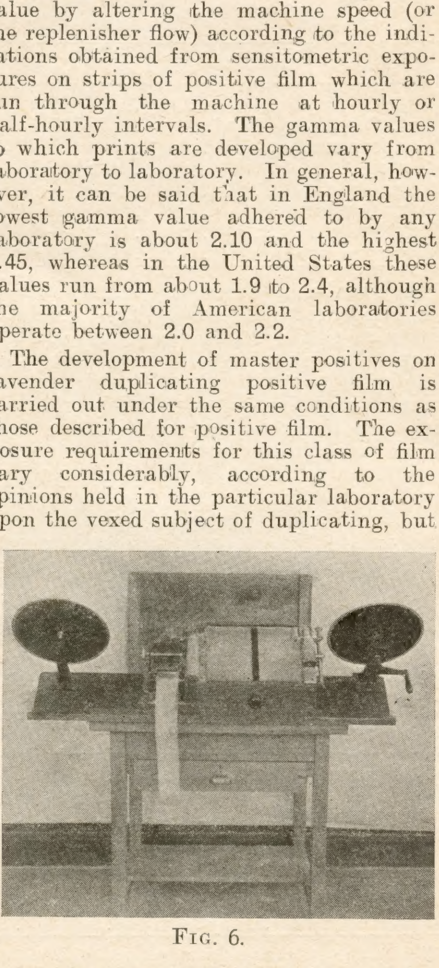

Fig. 6.

The opinions on the best method of handling duplicating negative material vary almost as greatly as do those on duplicating positive, but it is general practice to develop duplicate negatives in the picture negative developer to a gamma value of anything between 0.5 and 0.65, and the appearance of the developed film is slightly heavier than that of the original negative.

Developing Solutions

Developer formulas vary considerably in the various laboratories. For picture negative and duplicate negatives the developers used are of the Kodak fine grain D.76 type, with certain modifications of this formula to suit the conditions obtaining on the particular type of developing machine used.

The list given below gives some representative motion picture negative developers :—

(Grams to 1.0 Litre)

Chemical	D.76	A	B	C	D
Metol	2.0	2.75	1.35	2.0	1.0
Sod. Sulphite (Anhyd.) ...	100.0	100.0	100.0	100.0	90.0
Hydroquinone	5.0	2.75	1.35	5.0	0.75
Borax	2.0	8.0	1.0	8.0	1.0
Boric Acid	—	8.0	—	8.0	—
Pot. Metabisulphite	—	—	—	—	0.50
Pot. Bromide	—	—	0.50	0.025	—
Water to make	1.0	1.0	1.0	1.0	1.0

Replenisher solutions vary considerably, some laboratories using the original formula, while others use a double-strength solution. With regard to the development of Western Electric sound track negative, some laboratories, because of the particular type of developing machine used, are able to process this type of film in the same solution used for the development of picture negative film, but in general it can be said that a special borax formula must be used. This is due to the fact that sound recording film has a considerably higher rate of development than has picture negative film, and the requirements of the variable density system call for an extremely low gamma value ; consequently, the time of development of the negative track would be reduced to somewhere in the neighbourhood of two minutes in the normal picture negative formula, which is impracticable for control purposes.

For the development of positive prints, variable width sound track, duplicating positive, nearly all laboratories can be said to use a modification of the Kodak D.16 formula, which is a high contrast developer. Frequently the citric acid content in the original D.16 formula is omitted in the developer used by the laboratory.

Below are given some representative motion picture positive developers :—

(Grams to 1.0 Litre)

Chemical	D.16	A	B
Elon (Metol)	0.30	0.30	0.30
Sod. Sulphite (Anhydrous)	40.0	60.0	40.0
Hydroquinone	6.0	14.0	6.0
Sod. Carbonate (Anhydrous)	18.75	21.60	32.0
Pot. Bromide	0.90	0.80	0.90
Citric Acid	0.70	—	0.70
Pot. Metabisulphite	1.50	—	1.50
Water to make	1.0	1.0	1.0

A typical fixing and hardening bath for negative and positive film is :—

Hypo	240 grams
Sod. Sulphite (Anhydrous) ...	3.0 grams
Acetic Acid (28% pure) ...	18.0 cc.
Powdered Potassium Alum ...	6.0 grams
Water to make	1.0 litre

Printers, Printer Matching, Printing.

There is a wide variety of release printing apparatus used in the motion picture film laboratories throughout the world ; and it is manifestly impossible to do more than give a short explanation of a few of the different makes. In all release printers the negative and positive films are in contact at the moment of exposure.

There are, however, two different types of printer used for release printing, one in which the films move continuously past a printing slit called a "continuous printer," and the other in which the picture is printed frame by frame, called an "intermittent printer." Since it is obviously impossible to print sound by the intermittent method, intermittent printers usually have a further attachment for continuously printing sound track.

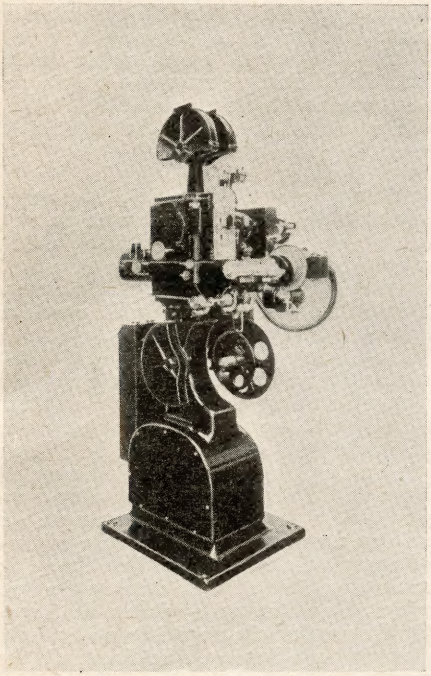

FIG. 7

In order to minimise slippage of the two films at the printing aperture on continuous printers due to the fact that the developed negative will necessarily be shrunken in comparison to the positive raw stock, it is customary to employ a curved gate on continuous printers.

A continuous printer largely used in the U.S. and also in this country is the Bell-Howell Model "D," shown in Fig. 4. The speed of operation of this printer varies somewhat according to the requirements of the laboratory in which it is installed, but in general it can be said to operate satisfactorily at the recommended speed of sixty feet per minute up to about one hundred feet per minute.

The model "D" printer, in common with most other types, is often considerably modified to suit the particular conditions obtaining at the laboratory. In their original form the model "D" printers print sound and picture in two operations, and in the United States they are often modified so as to print sound and picture as a single operation, thus effecting a decided economy in time. For the same reason the printer light change, which in the normal machine is effected by a variable shutter opening with a constant intensity light source, requiring an operator in attendance, is in many cases modified so that printer light changes are made by means of external resistances in the lamp circuits. Some of these printers are fitted with what are called "five-way gates," which are masks which can be moved so that sound track can be printed on either side of the positive at will, thus eliminating negative rewinding. Change of printing lights is made by means of a notch cut in the side of the negative film at the appropriate position.

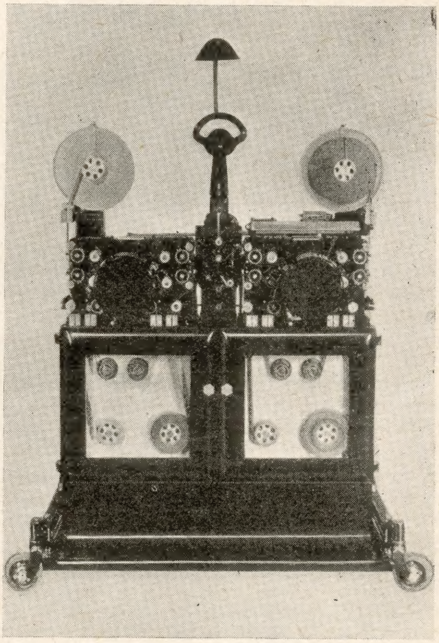

FIG. 8

Another form of continuous printer, used in laboratories in this country, is the Vinten rotary printer. The double unit, shown in Fig. 5, prints both picture and sound at a speed of one hundred feet per minute. The automatic light change is effected by means of a fibre chart 70 mm. wide, which runs at a speed one hundredth that of the negative to be printed (Fig. 6). The negative is graded by running the picture negative and the fibre chart upon a special machine in which the chart and the film run synchronously at their proper speed relation. A light change is effected by means of a punch hole in the chart, the position of the hole relative to the width of the chart determining the printer light value. There are twenty-one light changes.

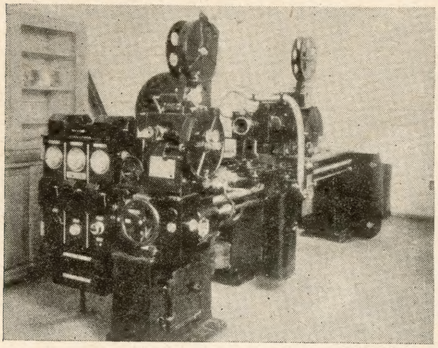

Fig. 9

The Lawley continuous printer, having a printing speed of ninety feet per minute, is also much used in this country. In each printer, sound and picture are printed in two operations. Two printers are frequently coupled and operate as one machine to print both sound and picture simultaneously. For the printing of news releases (an operation requiring the minimum waste of time) the lay-out of one of the largest laboratories in this country permits them to print no less than eighteen copies of a subject with one handling of the negative. Light changes on these printers are effected by means of external resistances in the lamp circuit, the changes themselves being made by an electro-magnetic device operated by the Lawley system of nickel clips, which wrap between two perforations of the film, the distance between two clips indicating the light intensity.

All the printers previously described have been of the continuous type. The most widely used intermittent printer in England and the Continent is the Debrie printer, shown in Fig. 7. This machine, which has a continuous printing attachment for sound, prints picture and sound as a single operation. Light changes are made by external resistances in the lamp circuit effected by notches cut in the side of the negative at the appropriate position.

Although not yet in use in this country, the latest Bell-Howell continuous printer, shown in Fig. 8, which prints both sound and picture as a single operation, deserves mention, because it embodies many new and practical features, amongst which is the means of making light changes by using a specially prepared travelling matte that varies the light aperture opening, using a constant intensity light source. This matte runs at one-quarter the speed of the film. Other features are the use of air pressure to ensure perfect contact at the printing aperture, the combination of compressed air and vacuum devices to clean the picture and sound negative and positive film while running, so that the printer can be run backwards and forwards without the necessity of removing the negatives at frequent intervals for cleaning. In fact, all the operator has to do is to thread the printer with positive stock, and the machine is so designed that if anything goes wrong the machine will automatically stop.

Optical Printers

There are other types and modifications of printers, notably those which have a series of printing gates so arranged that the same negative is printed simultaneously on to three or four different rolls of positive film. Probably the most interesting type of printer used in connection with motion picture film is the Optical Printer, the function of which is to produce various special effects, wipes dissolves, fades. Such printers are usually constructed to the requirements of the particular laboratory, and while the general principles involved are similar on all optical printers, there are many and devious ways of producing certain effects which are held by the laboratories as closely guarded secrets. To describe in detail a typical optical printer for special effects would be a task requiring considerably more time than the subject warrants in a general description of motion picture laboratory practice. It is sufficient to point out that this type of printer is a complex mechanism usually employing camera movements.

A Debrie Optical Printer for special effects is shown in Fig. 9. The operation of this printer is automatic and the various movements can all be pre-set.

From this discussion of a few different makes of printer it can be readily seen that there are two methods in use for effecting light changes. One of these methods is to use a constant intensity light source and make changes at the printing aperture by mechanical means, such as variable shutters, or variable aperture travelling mattes, and the other method, most popular in this country, of making light changes by means of resistances in the lamp circuit.

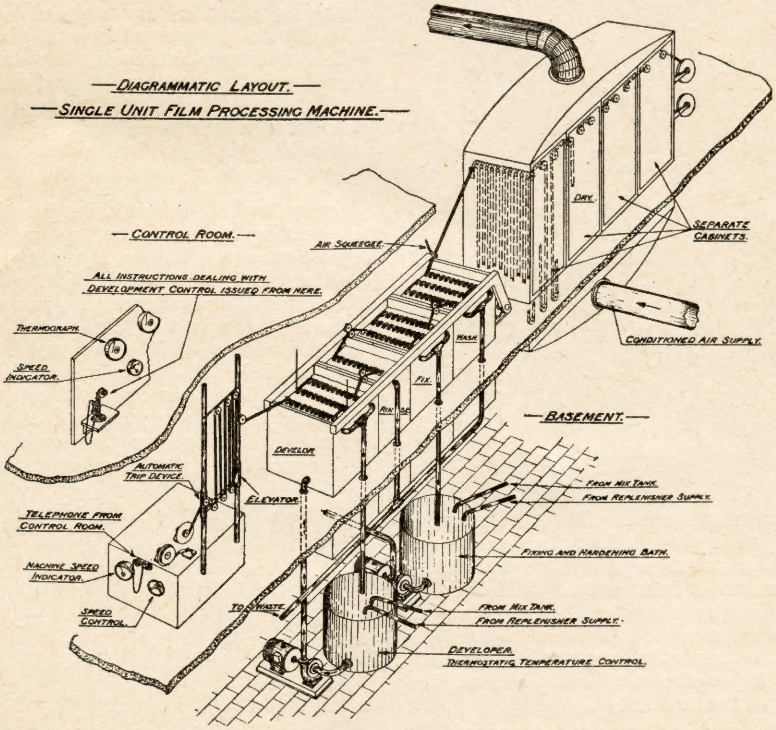

FIG. 10

In either method, all printers are matched by simple photographic photometry in which a print is made on all printers from a test negative using a certain printer light value on each printer and developing the prints together. The prints are then examined visually, or the resulting densities measured on a densitometer. If a printer is not giving the same results as the others, the necessary changes are made to bring it into alignment. These changes may involve the changing of lamps, the use of supplementary resistances, or an alteration in the position of the lamp, depending upon the type of printer used. Direct current is always used for printer light sources, and alternating current is frequently used for printer drives, when semi-synchronous motors ensure a constant printing speed. Printing rooms are usually kept at a 70 per cent. relative humidity.

The Cinex Sensitometer

The grading (as the determining of the correct printing exposure for a negative is called in this country) of picture negative is a visual operation in most laboratories, and to assist in this operation the well-known Cinex Sensitometer is used by some laboratories. This instrument makes a print of eleven frames of the negative to be graded, each frame being given an exposure which is similar to that given for certain light values on the printers.

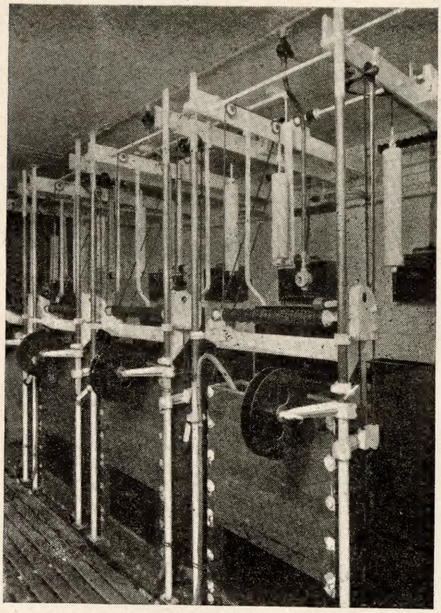

FIG. 11

General practice is for the man in charge of the grading operation to visually examine the negative and assign a light change value to each scene. While doing this he either notches the negative or attaches clips to the perforations or performs the operation required to ensure that a light change takes place at the proper moment on the printer.

Sound track is generally graded by density measurement, and since in release print work the sound negative has been rerecorded and therefore is balanced for exposure, one printer light value is generally sufficient for printing one reel of sound negative.

Developing Machines

All laboratories use continuous developing machines, the size and output of which vary according to the requirements of the particular laboratory.

A developing machine usually consists of a feed-in end, comprising a splicing table over which runs the roll of film to be developed, and an elevator, which is a series of loops of film containing a large enough footage to enable the machine operator to splice, or staple, on a fresh roll of film to the one in process of development without affecting the film speed in the machine. After passing through the elevator the film goes through a series of tanks containing the developer, rinsing, fixing bath, and washing water, and passes into the drying cabinet, at the far end of which is (in some cases) another elevator to permit the operator to remove a processed roll without changing the film drive speed. In Fig. 10 is shown the general lay-out of a single unit continuous developing machine, with the circulation system indicated. Since continuous developing machines differ considerably in design, however, it will be advisable to briefly discuss several different types of installation.

Some English laboratories use the Vinten developing machines, which are designed so as to be readily adaptable to existing buildings with the minimum alterations. For instance, the machines require rooms only nine feet high, and the rooms need not all be on one floor. In the standard machine the range of developing time, from three to eight minutes, is effected by a change in speed of the film drive. Each machine, assuming that a development time of four minutes is required, has an output of 2,250 feet per hour.

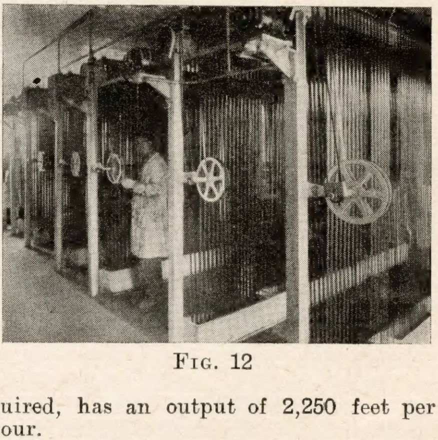

FIG. 12

The developing tanks have steel columns on either side. Attached to these columns is the sprocket drive shaft, which is driven by the vertical chains, see Fig. 11. The sprocket shaft slides up on the two columns for the initial threading up of leader film. In threading, the film is passed beneath the weighted roller of the first sprocket, with the emulsion outward, then down into the tank and up to the next sprocket, and so on, a weighted diabolo hanging in each loop of film in the tank. After development, the film passes into the next compartment for rinsing and fixing.

The rinsing and washing are done by fine jets of water directed upon the film as the latter hangs suspended in the tanks. A suction nozzle removes all surplus water from the film before it enters the drying-room, shown in Fig. 12. In this room diabolos which hang in the film loops are placed in racks, which prevent them from swaying. Conditioned air for drying the film is fed through ducts along the sides of the room. Most laboratories using this type of equipment employ some form of developer circulation and temperature control.

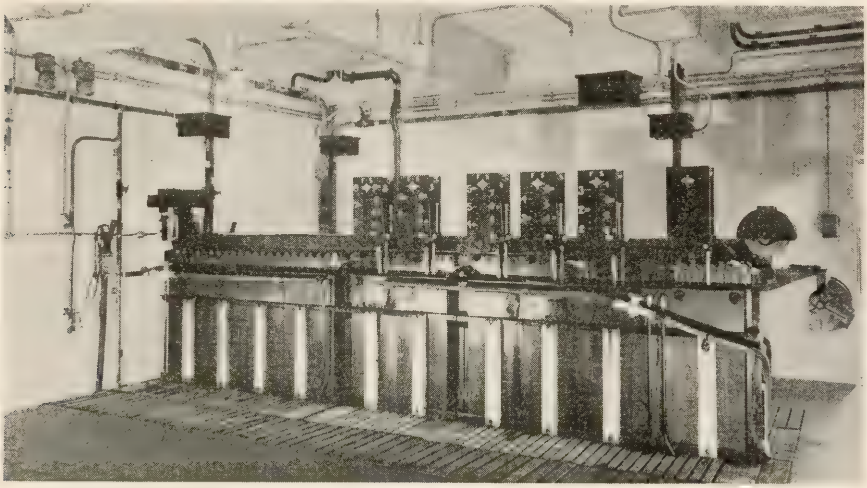

FIG. 13

One of the largest laboratories in this country uses Debrie equipment. The developing end of one of these machines is shown in Fig. 13, this particular machine being used for developing picture negative film. The time that the film remains in any solution is made known to the machine operator by the control boards at the top. Alterations in the time of development or of fixing may be made by moving a lever upon the appropriate control board, which is calibrated in minutes and seconds. The speed of these machines is in the neighbourhood of 25 feet per minute per unit. In Fig. 14 may be seen the washing and drying end of the same machine. A feature that is usual in most developing installations in this country is the provision of a wall dividing the developing machine into a dark end and a light end. A Carrier installation is used for conditioning the air for these cabinets and also for controlling the temperature of the developing solutions.

Speeds

While the various machines so far described operate at a lower speed in feet per minute than is usual in the U.S.A., one laboratory in this country has built several positive developing machines, each designed to give an output of from 180 to 200 feet per minute. It is believed that, to date, this is the fastest output for one machine operating upon a commercial scale in any country. In these machines, which were designed and built by the laboratory itself, the film is driven by frictional means, and the film perforations are not used. Each machine uses 260 gallons of developer and 50 gallons of replenisher solution for developing 180,000 feet of positive film in seventeen hours. Each machine has a separate circulation system and temperature control and elaborate precautions are taken to safeguard against breakdowns during a run.

The control of development is the responsibility of a sensitometry department, which controls the machines according to curves plotted from exposures on the Eastman Type 2B. Sensitometer, passed through each machine at half-hourly intervals All instructions dealing with machine control are telephoned from the control room to the machine operator, who has no responsibility other than the mechanical care of the machines.

A new type of developing machine, a number of which are in process of installation in this country at the present time, is the Debrie Multiplex, shown in Fig. 15. This machine embodies many new features, and its performance in production will be watched with interest. It is of the friction drive type, that is, no sprockets are used, and since it is completely light-proof the developing processes can take place in a well-lit room. Inspection is afforded on certain sections of the machine by means of windows containing shutters and neon lights which operate only during inspection give the appearance of a stationary film. Other unusual features are the drying cabinets, which are similar in all respects to the developing tanks, and the fact that each tank has a door the entire height of the tank which can be opened for purposes of cleaning.

Before concluding this discussion of developing machines, attention should be drawn to two features of modern practice For instance, in order to overcome " directional effects " many laboratories are increasing the developer circulation rate and, in addition, are forcing developer through fine jets under the surface of the developer in the tank. Directional Effects are caused as the film travels through the developing solution in the machine by the diffusion of development products from an exposed area on to another area that has received a different exposure. Another feature of interest is the use of electrolytic regeneration of the fixing bath, which both regenerates the fixing bath and recovers the silver.

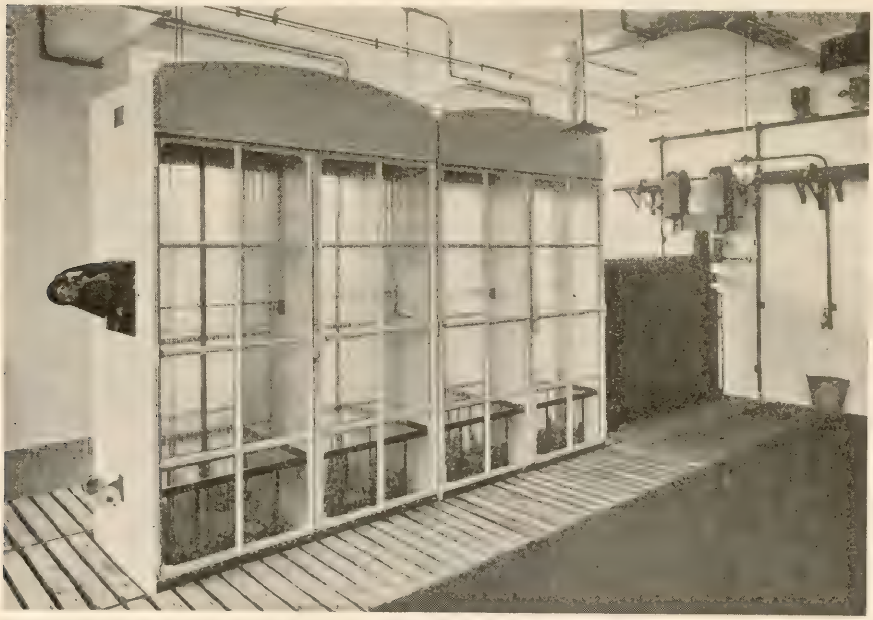

FIG. 14

Negative Examination

After development, it is customary to make a careful examination of the negative for surface dirt, abrasions and scratches. Most laboratories clean the processed negative film with carbon tetrachloride by hand immediately prior to printing, and negatives in process of release printing are cleaned at intervals between printings.

Print Examination

Many laboratories in this country project every print for sound and picture quality. This does not apply to news specials, of course, where time is a vital factor. It is customary to project about every fifth copy of a news special. Many release prints are lubricated by edge waxing before shipment.

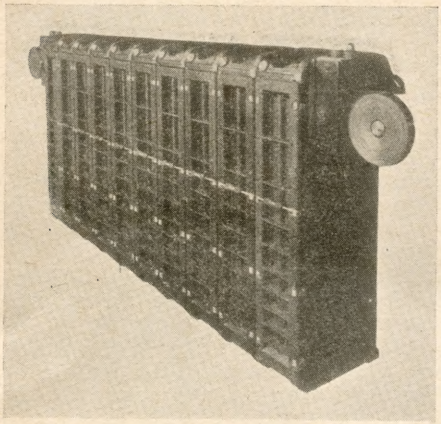

FIG. 15

From this short description of some of the methods and equipment used in the modern motion picture laboratory it will, I think, be apparent that the developing and printing of cine film in large quantities is a series of operations requiring precise methods of control. In so far as development is concerned the action of the bath on the film can be controlled within narrow limits by utilising the data obtained from sensitometric strips run through the developing machine at frequent intervals, a method capable of far more accurate results than are obtained by visual examination of the film during development, which indeed is impossible with modern machines running at over one hundred feet per minute. The only operations not achieved by mechanical means in the majority of large laboratories is the grading or timing of picture negative for printing purposes, and, in some cases, the judgment of development time for picture negative takes. Air conditioning plants assist greatly in maintaining print quality control as well as benefiting the health of workers, and most large laboratories are now so equipped.

DISCUSSION

Mr. WATTS: Has any progress been made in regard to the experiments in gas developing—have Kodaks done anything in that way?

THE AUTHOR: Gas developing is a subject on which I am ignorant, but I do not believe it has been applied to the developing of motion picture film in large quantities.

Mr. CRICKS: Mr. Wratten favours big high-speed development machines. It seems to me that a number of slower and smaller machines cost practically no more and take up little more space, and should be, surely, more convenient for use. What exactly is the advantage of the big, high-speed machines?

THE AUTHOR: Mr. Cricks is quite right in his query, because there are definitely two schools of thought. The high-speed machine, of course, has a very big output, but it is possible to make very much simpler machines.

There is, for instance, a type of developing machine in existence, in which the processing solutions are carried in a series of wide, long, shallow trays, enabling several rolls of film to be developed simultaneously. While the film travels relatively slowly the output is fairly high, because several rolls of film will be coming off the machine at the same time.

Mr. WAXMAN: Mr. Wratten, can you tell us exactly how the neon light inspection chamber in the Debrie can overcome the question of fogging the film?

THE AUTHOR: I am afraid I am unable to say how they overcome fogging in the method employed. As a matter of fact, I think that particular query was taken up by the laboratory which was installing them in this country, with the result that the neon light inspection windows are going to be omitted from these machines.

Mr. CHARLES VINTEN: Mr. Wratten mentioned edge-waxing in the U.S.A. Some while ago they were completely waxing the surface of the film and then buffing it. Are there any further developments in this direction?

THE AUTHOR: In the U.S.A. the majority of release prints are lubricated only by waxing the edges. A number of American laboratories, however, favour both edge-waxing and preservation, and in these cases the complete emulsion area is treated in some manner in a special machine.

Mr. Waxman: Do they use matting machines?

The Author: No; matting is considered in the U.S. as being very bad form as it affects the actual quality of the negative.

Mr. Eveleigh: I suppose they would rather make a new neg.?

The Author: Yes, or suitably eliminate scratches by the use of an optical printer.

Mr. Bill Barker: In the first picture —I think it was of a sensitometer—how do you calibrate your source of light?

The Author: Two calibrated lamps are used with the type 2B. Sensitometer, one for use in exposing positive film and the other one for negative film. The exact current in amperes, the voltage tolerance, and the distance at which the lamp must be set to produce the standard illumination on the exposure plane are provided with each lamp. The lamp for positive film is standardised for candle-power when operating at a colour temperature of 2600 deg. K, and that for negative at 2360 deg. K. Filters are used to bring the colour temperature of the light exposing the positive film to 3000 deg. K, and that for negative film to 5400 deg. K.

Mr. Alderson: There is just one little point which I thought he raised—of Test Strips for development of studio negative. It has always been rather a query to get a level quality of negative and to consider the cameraman from the laboratory point of view. There is a certain amount of feeling that the lab. side do not always help the cameraman as they might, and there is the point that so many cameramen would much rather have a Cinex strip than their own strip of negative. I have known several cases when a cameraman has passed test strips, which had a variation of as much as five printer light points, as good negative. I think many here will appreciate that from a quality point of view that is quite wrong. A level negative is the best thing to give a level quality in the final print. I wonder whether Mr. Wratten would make a definite statement as to whether he considers the test strip or constant gamma method to be the better for negative development.

The Author: Perhaps I may be allowed to answer Mr. Alderson's query.

Personally, I believe that the development of all studio picture negative should be controlled by sensitometric methods. The modern motion picture laboratory has means at its disposal to ensure accuracy of the development processes from day to day and from hour to hour. Consequently, whether the system is used by which all picture negative takes are developed to a uniform gamma value or whether the test strip method is used is not of paramount importance provided that there is a definite and accurate control over the developing solutions themselves. It is, of course, impossible to obviate entirely errors of personal judgment, but with the aid of precision control methods the laboratory is in a very much better position compared to that of the lighting expert in the studios, who depends almost entirely upon his personal judgment based upon experience.

Two reels from the M.-G.-M. film, "San Francisco," were shown on the screen.

Mr. Gare Schwartz: I think a very enlightening point is the fact that we have not only just seen some trick shots, but the result of team work between each and every department of the production unit to attain the final result. If you were to take the series of the scenes shown this evening, cut out the trick shots and run them individually, perhaps we might not feel so terribly enthusiastic. If we had to make similar shots to those shown (optical, back projection, combination and matting), we wou'd make them more or less in the same way, and certainly get the same effect, but I repeat that the great point in this film and in all trick work is combination and co-operation of all departments concerned.

Mr. Oram: Does Mr. Schwartz suggest that there is nothing new or different in the trick shots in that film? Would you recognise them all as trick shots that you have done before?

Mr. Gare Schwartz: The method of application of a particular trick is very important. I dare say, here in England, you have made trick shots which are just as good, but perhaps the trick man did not have the opportunity to apply his work to its full advantage because of the lack of co-operation of those concerned with the production.

The Author: I think, Mr. Chairman, as Mr. Schwartz has said, that the scenes themselves—of course they have tremendous dramatic value—have been done before. The technique is very well known, and, as far as I can see, they are a combination of both optical printing and back projection.

Mr. Eveleigh: I think our thanks are due to those who combine the whole thing, the editors. Some of that montage was masterly—better than any Russian montage, and they, of course, were the originators of this type of cutting. The dubbed sound was masterly, too, so far as the actual technique was concerned.

Mr. Waxman: It stands to reason, surely, that a modern trick department has much more scope and better apparatus to carry out superior effects. Optical printing, for instance, is a new innovation in the trick department.

The Author: The optical printer reached its present stage of—practically—perfection between five and seven years ago. Since then it has been improved in minor directions only.

Mr. Eveleigh: I was at Culver City in 1927, and assisted in making an avalanche where we destroyed all the huts on a mountain side, and it was equally as good as the scenes we have seen to-night. I think the difference lies in the addition of sound, which we missed so badly in the old days. Divorce sound from what we have just seen and run it silent—it would make a great difference.

Mr. Gare Schwartz: I think it would be very instructive at a future date if this or a similar reel were shown twice, first as it would be seen by the public, and, second, the trick shots broken down and separated from each other with blank spacing, and we would immediately see how important other departments are to the trick shots and their success.

Mr. W. Buckstone: A very interesting point is that some of those were built-up effects, and it would be interesting to have a definition of a trick shot.

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